



Iowa Water Science Center

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Mapping the Missouri River

For the past year, the USGS (U.S. Geological Survey) Water Science Centers in Iowa and Nebraska have been conducting hydrologic and land surveys to provide streambed elevations, and measurements of the volume and speed of the Missouri River water at select locations. The U.S. Army Corps of Engineers commissioned the study to help them evaluate the effects of their habitat improvement structures put in place within the river channel.

History of the River

Early explorers of the Missouri River found many obstacles along their way. It is estimated that 400 steamboats and smaller vessels sunk because of collisions with submerged trees. Those that made it through were often slowed by the many bends and loops of the river as well as its ever-shifting channel. A need for a safe passageway increased as America moved westward. The Missouri served as a major transportation route for transporting supplies.

Commercial interests quickly became the primary concern since environmental issues were virtually non-existent. The Missouri River basin ecosystem was almost entirely lost as nearly 130 miles of shoreline were eliminated as bends and meanders were cut off. Farmers took advantage of this additional land by planting areas that had at one time been natural wildlife habitat. Upstream from Sioux City, dams were built to regulate the inconsistent flows due to flooding and drought. Because these dams created large reservoirs, even more natural habitat was lost leaving very few places for wildlife to thrive. The river below Sioux City was so completely reformed into a man-made entity that it had virtually no resemblance to its original state.

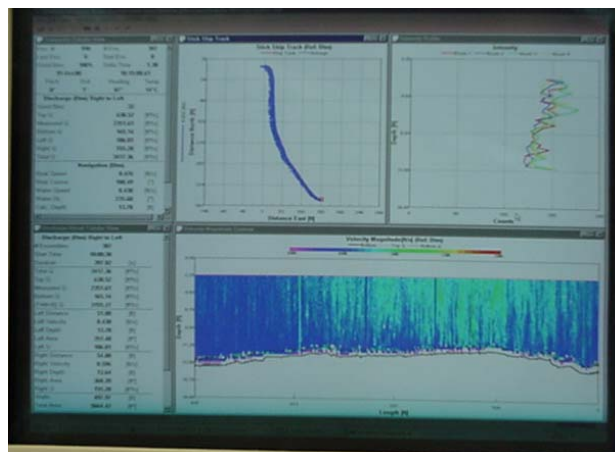
The effect of straightening the river has been met with mixed results. Channelization had given

owners near the river some security from yearly flooding. It also allowed for thriving barge traffic below Sioux City, however, this has been on a steady decline since 1977. The floods of 1993 caused officials to rethink how to control the water during heavy rains. The river was now running faster and higher due to the deep channelization and levees. Recreating natural floodplains is now being seen as a significant aid in dispersing and slowing the river after a substantial rainfall.

As protecting our environment has become an important issue, the role of the Missouri River is being redefined. The Corps has had to include environmental concerns into its program. They have begun to install structures like water diverters and are dredging side channels in an attempt to create a more natural river for endangered species such as the Least Tern, Piping Plover and the Pallid Sturgeon.

The Role of the USGS

The USGS is collecting data to map the physical features within the boundaries of select Missouri River bends. Data collected by the USGS will help determine if structure construction and modification has helped develop river habitat as planned by the Corps. The USGS has been using



Screen print from ADCP

bathymetric technology and topographic studies to profile the Missouri River flow and bed elevation. An ADCP (Acoustic Doppler Current Profiler) is a key component of this technology. It is used to measure the depth and speed of the river. The ADCP is mounted on a boat and measures water currents by transmitting sound waves – “pings” of sound. As the sound waves travel through the water, they reflect off the particles, such as silt, that are suspended in the moving water and return to the ADCP. A collection of pings work to create an ensemble that is used to determine the absolute speed of the water current, the direction of flow, and the depth in the water column to the river bottom. This gives an almost complete picture from the surface to the bottom of the river.

The surveying work being done along the Missouri is time consuming but that time has been significantly reduced from years ago with the advent of new technology. While it used to be a challenge to obtain 4 cross-section measurements per day, today a boat crew can take readings on up to 80 different cross-sections each day with an accuracy that was unobtainable before using ADCP. In the past, cross-sections were measured by stretching a cable across a river and then taking measurements of depth at selected intervals along the cable. Weights were attached to ropes to get the depths. More people were required, less data was obtained and the work was dangerous.

Today the accuracy and frequency of the data provides a much clearer picture leaving less room



for interpretation of what is happening below the surface of the river. The USGS analyzes the type(s) of bed material in the river helping to identify what kinds of wildlife habitats are available. Land surveys are also being conducted to determine the make-up of the river banks using Real Time Kinematic GPS and optical survey equipment.

The Iowa and Nebraska USGS Water Science Centers have agreed to gather data on 20 river bends from St. Joseph, MO to Gavins Point, NE for the habitat availability studies. Six locations were studied in 2005, those six will be revisited and the remaining 14 are scheduled to be completed during 2006 – a challenge to the already fully committed USGS staff.

The USGS continues to be respected for its ability to conduct unbiased scientific studies for other Federal agencies, the State, and local municipalities. As a non-regulatory agency the USGS is proud of its rich history of quality data collection.

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Or visit: <http://ia.water.usgs.gov>

For further information about the instrumentation used:

The American Surveyor - Winter 2005
http://www.theamericansurveyor.com/PDF/TicanSurveyor_Penry-MappingTheMissouri_December2005.pdf